An Energy Efficiency Workshop & Exposition

Kansas City, Missouri

FEMP's GHP Core Team: Mainstreaming Geothermal Technology in the Federal Government

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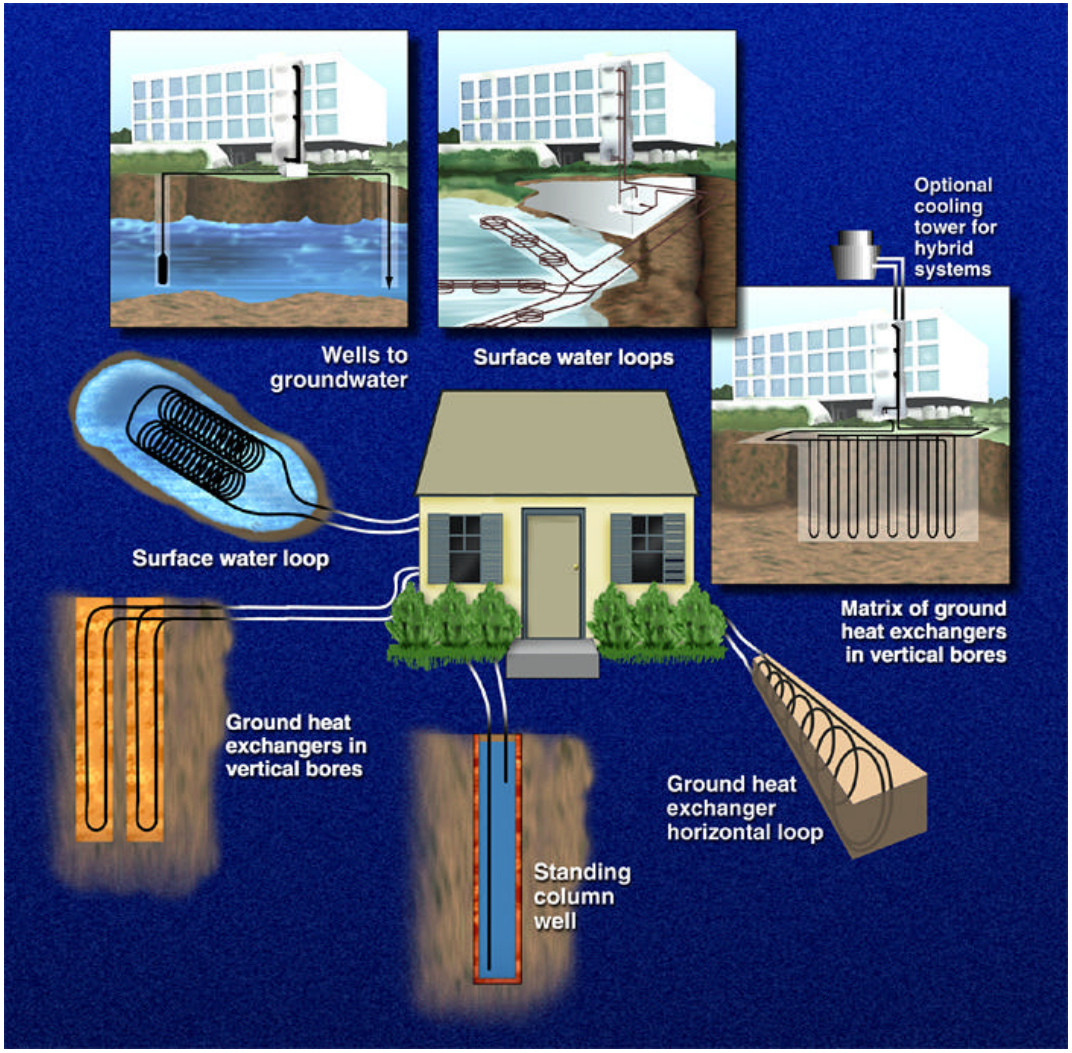
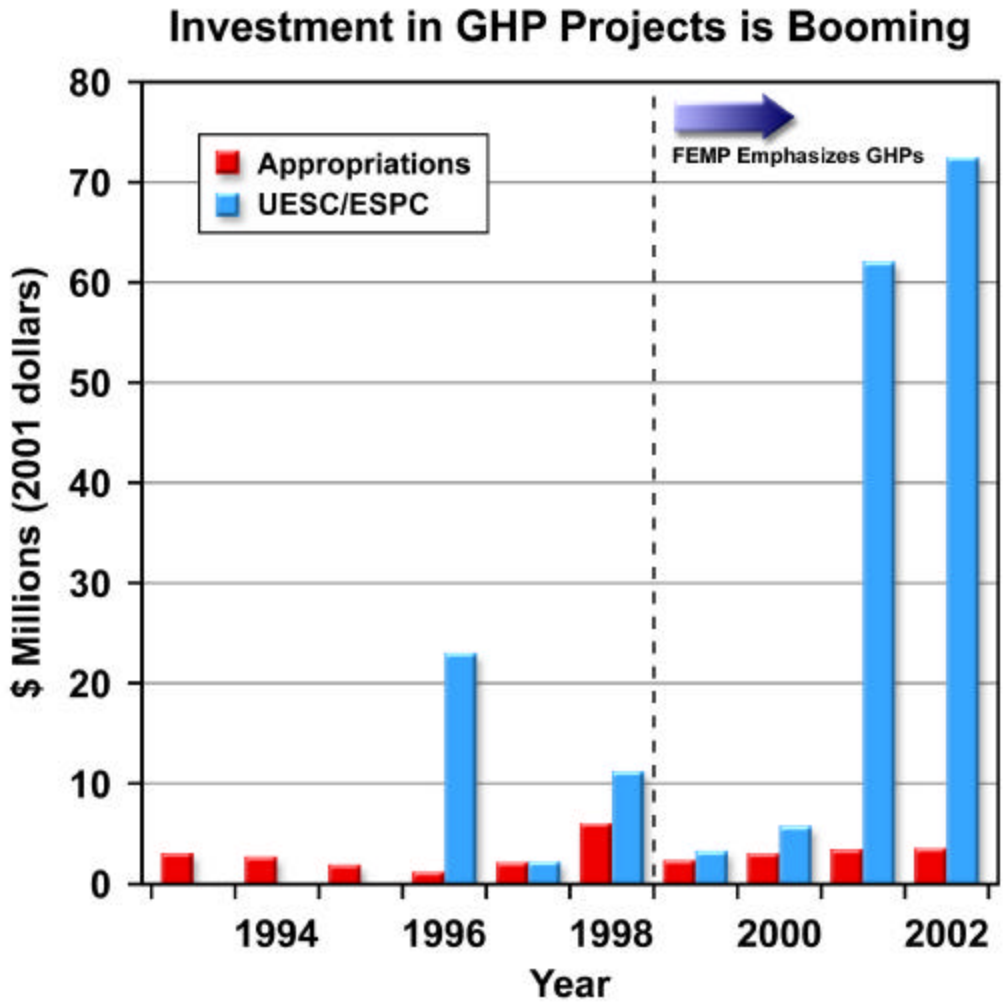
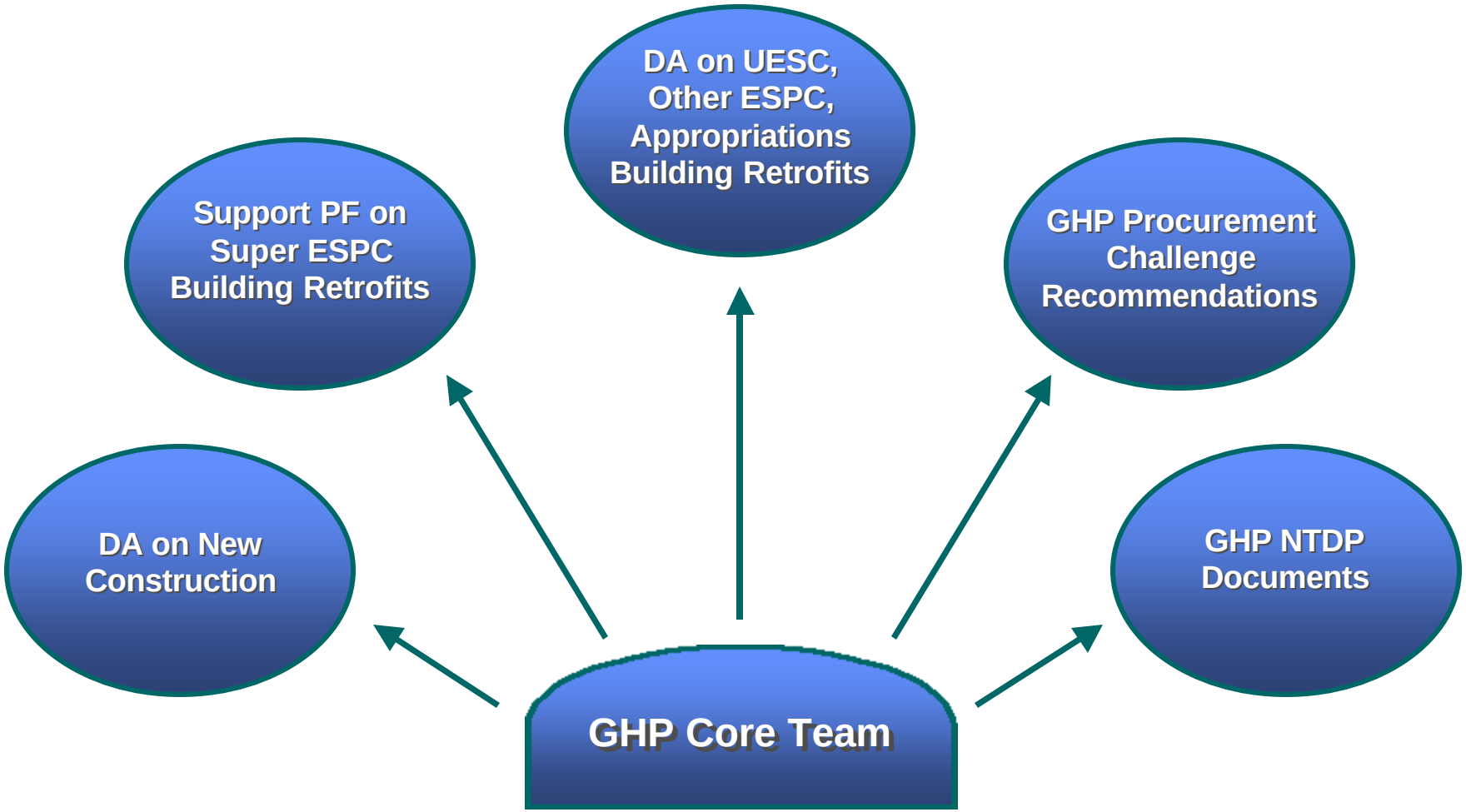
GHP System Options



GHPs in the Federal Government



FEMP Tech-Specific Success:
Geothermal Heat Pumps



Activities of GHP Core Team

- Design assistance to Federal agencies
- Assistance to Project Facilitators
- Compilation of data from all Federal GHP projects allows development of:
  - Construction and maintenance cost database
  - Survey guide
  - Energy estimating guide
  - Design and analysis tools

GHP Core Team Strategy

- Priority: solutions to real project problems
- Support any federal GHP project
- Use best-practice projects to
  - prove techniques
  - provide data for benchmarks and guides
- Leverage work of others
  - GHPC, IGSHPA, ASHRAE, etc.
- Support development of GHP infrastructure

GHP Design Assistance

- UESC project Southeastern military base
- 1253 family housing units
- Mostly 1.5 - 2.0 ton vertical bore GHPs
- Designer chose to size heat exchangers to limit EWT to 95 °F
- Base requested Core Team to:
  - Analyze equipment selection and borefield designs
  - Determine the effect of lower design EWT

Potential problem corrected

- Worked closely with designer and base energy manager.
- Developed independent model of a residence with GHP, analyzed designer's assumptions
- Our loads turned out to be higher than the ones the designer had assumed.
- No problem with EWT, but we recommended that bore depths be increased by 30%

More GHP Design Assistance

- ESPC at east coast military facility
- Uncertainty over required size of GHPs for family housing units
  - 3 ton units had been installed
  - Apparently unable to meet setpoint
  - Two other designers recommended larger units
- Core Team was requested to examine the design

This study is in progress

- Have developed independent model of building
- Preliminary results indicate that 3 ton unit should be adequate
- Examining effect of using supplemental heat
- Checking borefield sizing

Assistance to Super ESPC Project Facilitators

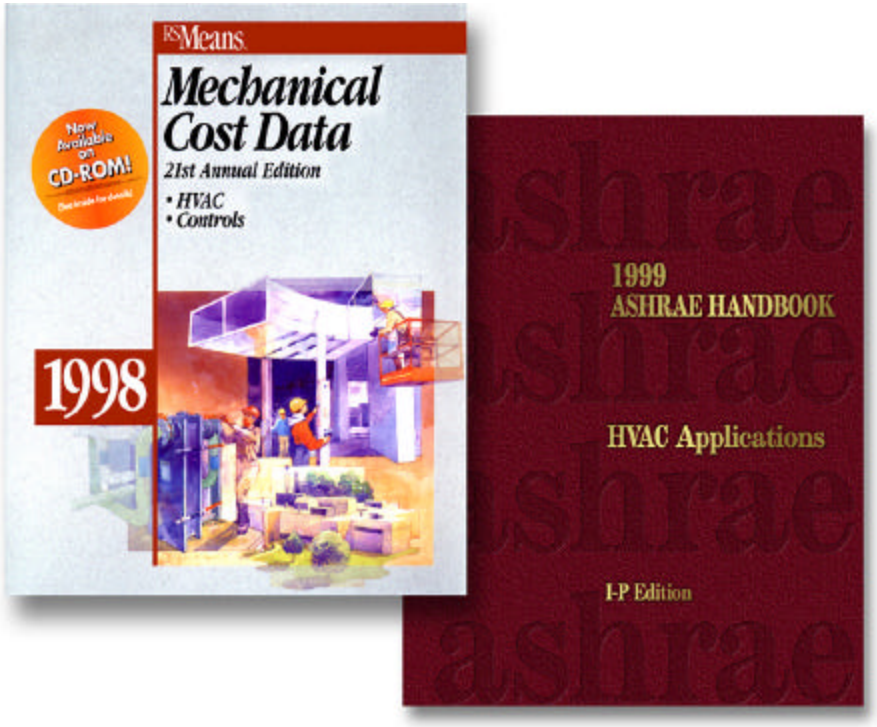
- Conversion of five buildings at a Northeast U.S. Naval facility to GHP
- Using calibrated simulation model to develop baseline energy and savings estimates
- The model will form the basis of M&V plan (type D).
- Baseline model predictions did not match metered data

Core Team involvement allowed project to proceed

- Analyzed building models and metered data
- Recommended installation of temporary metering
- Worked closely with project designer to match building model to temporary metered data
- Achieved resolution, giving base personnel & Navy PF's confidence in baseline estimates
- Project now going forward

Core Team is developing standard tools of the trade

- Guide specs
- Survey guide
- Construction and maintenance cost-estimating guides
- Managing ASHRAE GHP research



Increasing confidence in GHP cost estimates

- RS-Means is the industry standard for cost estimating
  - Does not include many GHP components
- Available GHP cost data largely anecdotal with important factors unknown
  - Type of estimate: preliminary, per square foot, bidder price, etc.
  - Scope: whether costs for site work, design, electrical, demolition, controls, etc., are included

Developing an Independent Construction Cost Database

- http://public.ornl.gov/BTC_MIC/logon.cfm
- Information available on GHP and conventional HVAC equipment
- Construction cost and maintenance data available
- Database has been “seeded” with ~75 initial projects
- Public participation encouraged

Logon Screen for Cost Database

Buildings Technology Center

HVAC

Construction and Maintenance Cost Survey

Log On to the HVAC Survey

If you have previously registered with us, please enter your User ID and password below. If you have not registered and would like to participate in the survey, click here.

User ID:

Password:

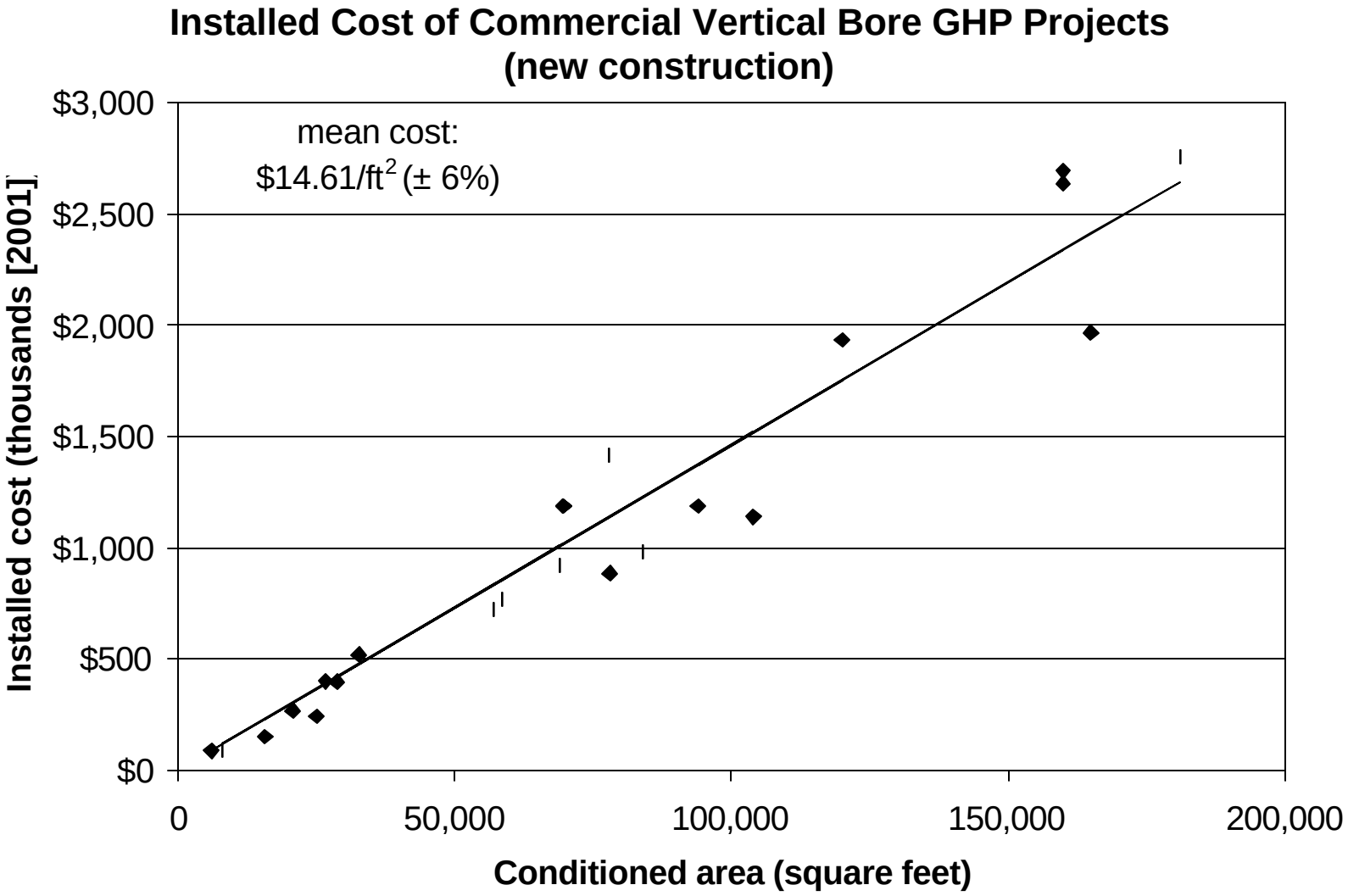
Log On | Reset

The HVAC construction and maintenance cost **survey** has been designed to collect recent, thorough information on new, retrofit, or replacement HVAC construction projects and HVAC maintenance costs. The **database** makes this information available to engineers in the public and private sectors to use as resources in developing projects and performing feasibility studies.

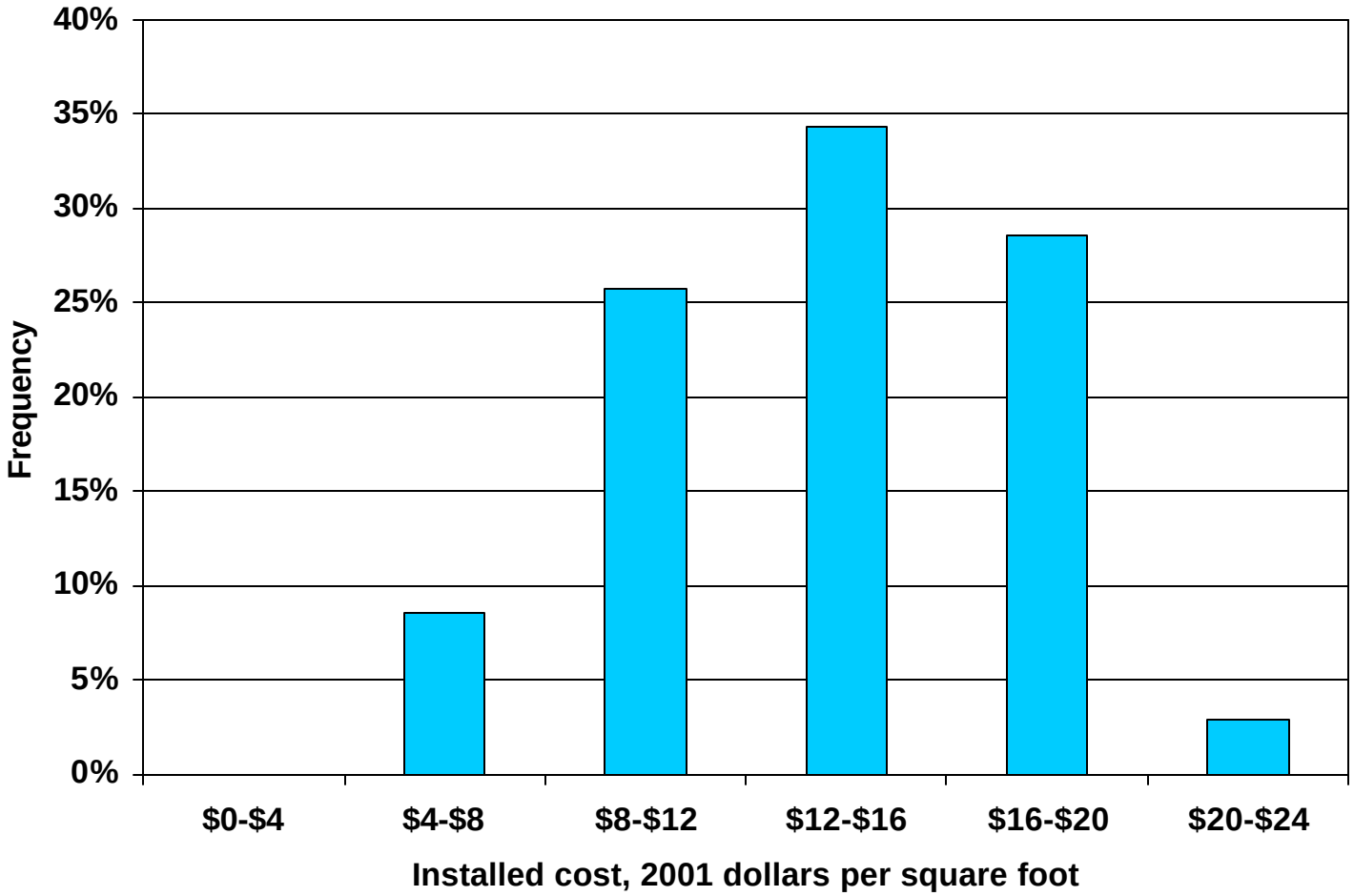
The survey has the following features:

- It allows you to tailor it to accommodate the data that you are willing to provide. After you have provided certain types of required information on building and system characteristics, you may choose to provide information on construction costs or maintenance costs, or both. Likewise, you can provide total cost data or itemized cost data.
- At any time, you may review your input from the Survey Menu screen.
- Your participation is confidential. You will create a unique User ID and password, so that you may input, access, or modify your own data. All identifying information will remain private; only your

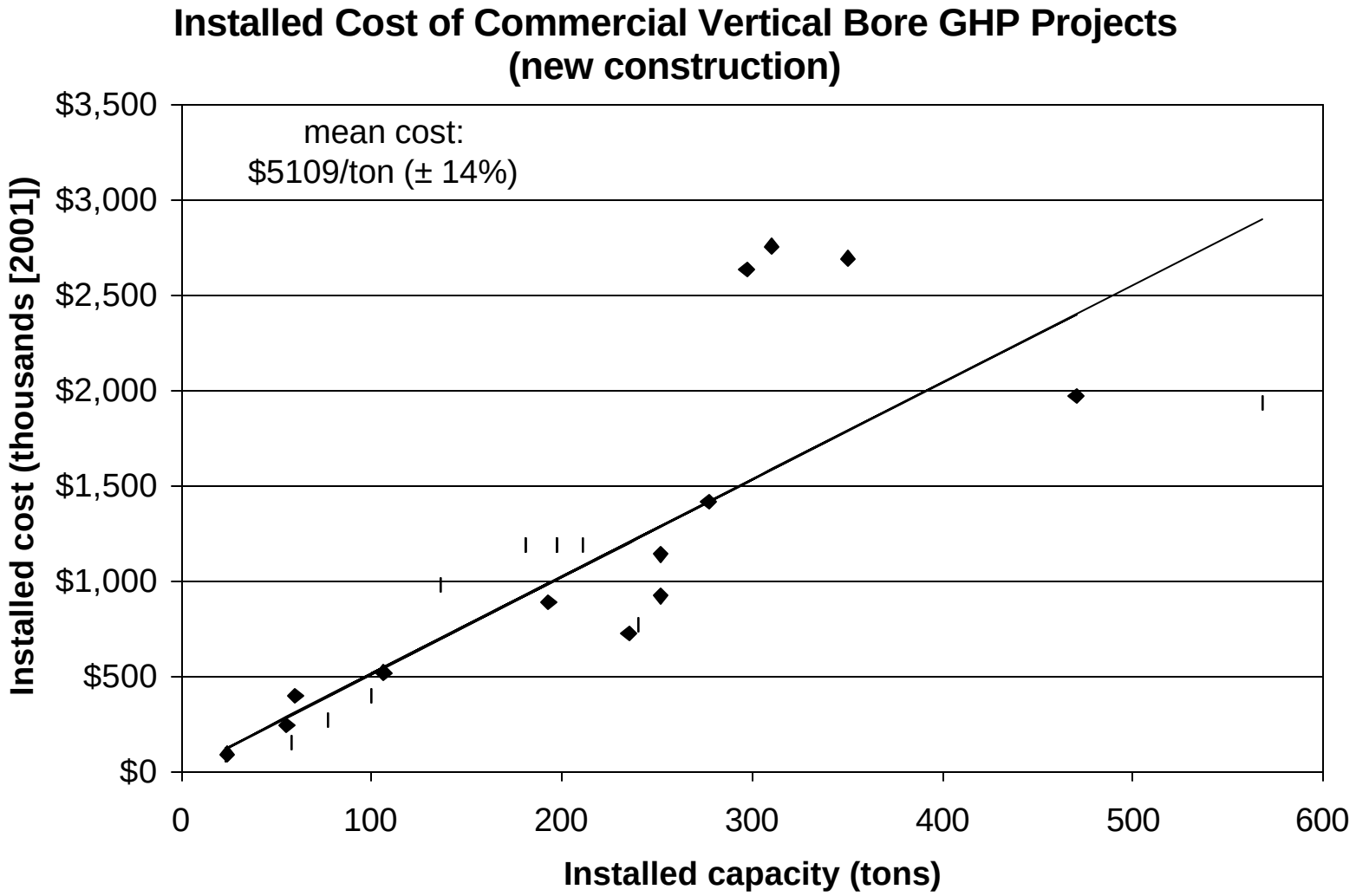
Database output



Distribution of GHP project costs (new construction only)



Database output



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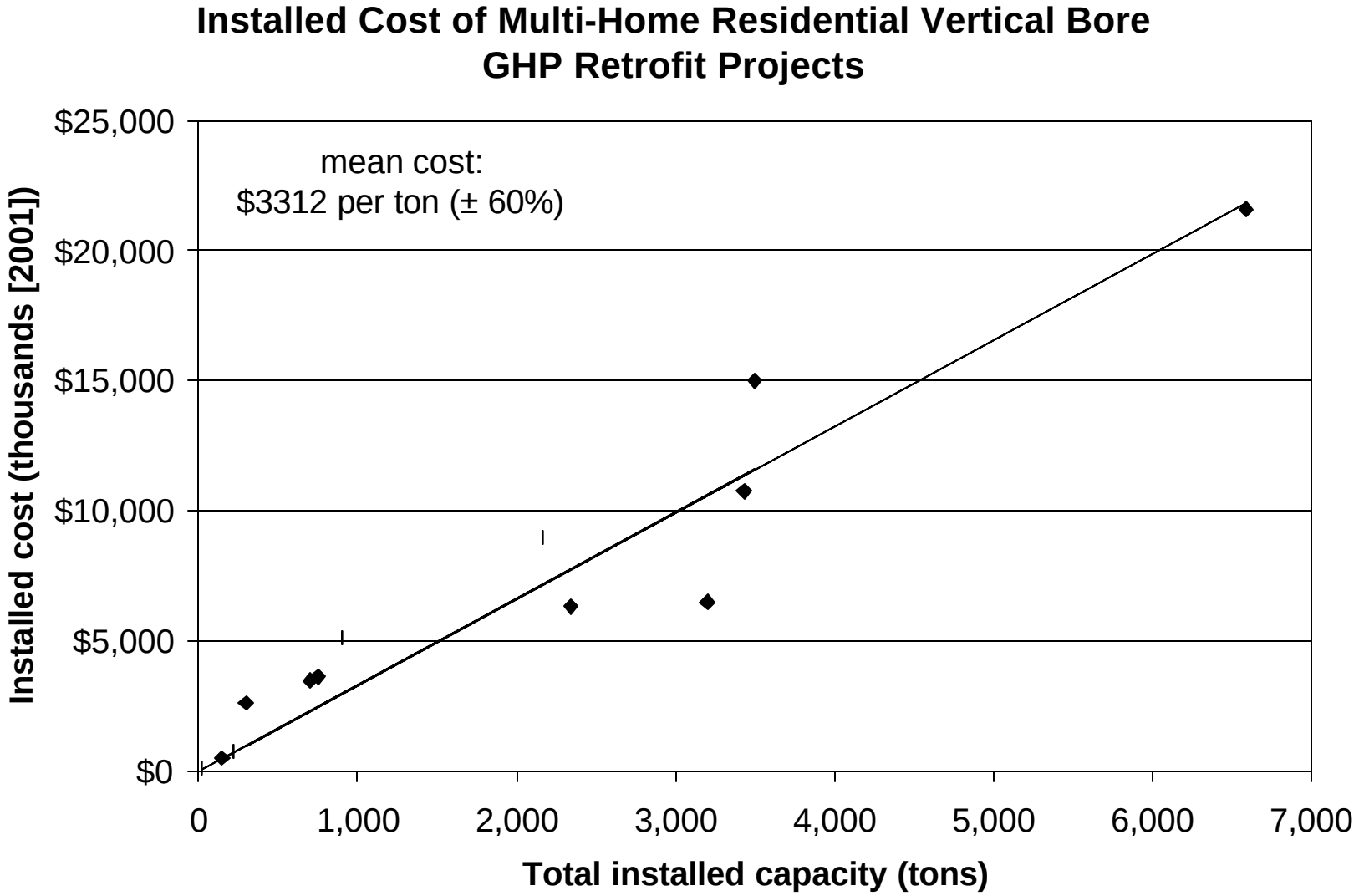


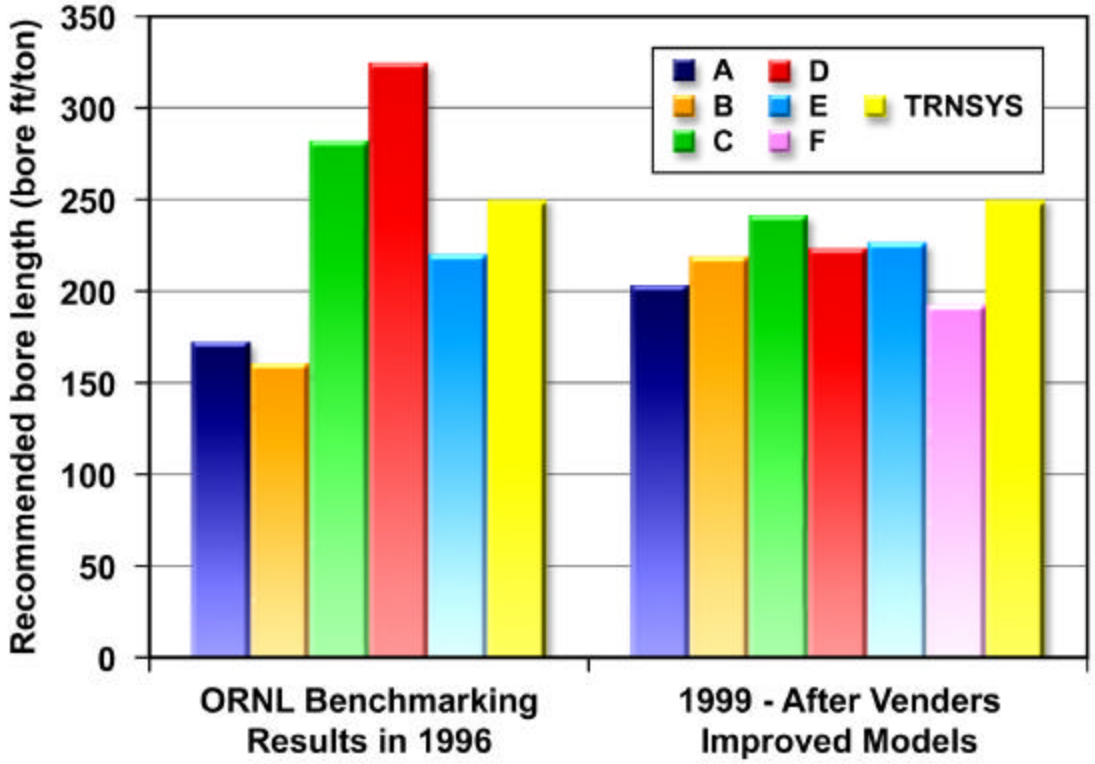
Summary for Vertical Bore:

- Commercial New Construction
  - $14.61 per square foot (± 6%)
- Commercial Retrofit
  - $11.50 per square foot (wide variation due to small dataset)
- Large Residential Retrofits
  - $3,312 per ton (wide variation due to small dataset)

Construction Cost Database is a work in progress

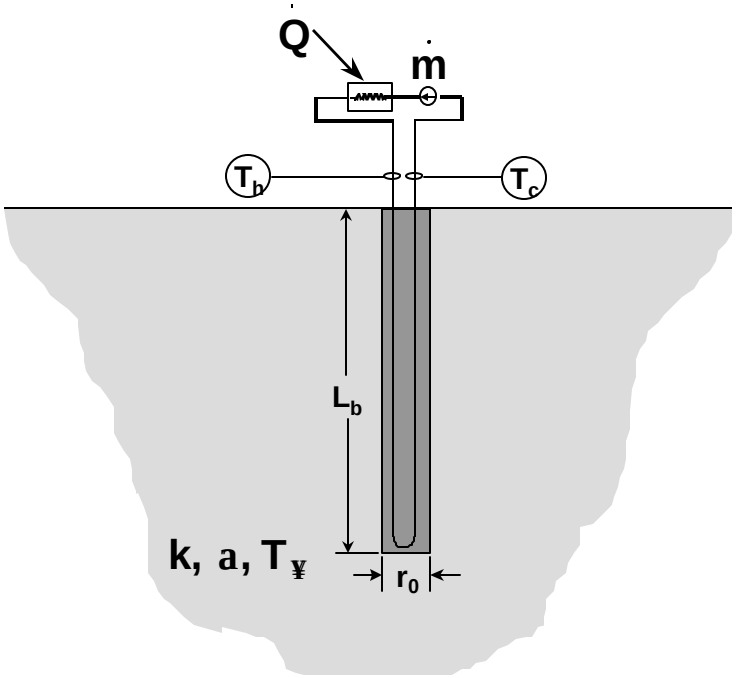
- Current information is not definitive
- Much more data is needed to achieve statistical significance
- Success will ultimately depend on participation by the public
- Also covers maintenance costs

Improving tools for design



Improving tools for design

- Subsurface thermal properties vary widely.
- They must be estimated from measurements at the site to design systems for maximum efficiency and minimum cost.
- ORNL developed a method to get better estimates faster.



Summary: The GHP Core Team levels the playing field

- There is still uncertainty over GHPs in the Federal government:
  - Design issues
  - Cost estimates
  - Energy savings estimates
  - Applicability
- GHP Core Team provides Federal customers with the same expertise that exists in the industry

Contacting the GHP Core Team

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